



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/550,816	04/18/2000	Anders Andersson	08305-072001	2139
7590	05/20/2004		EXAMINER	
Thomas J D'Amico Dickstein Shapiro Morin & Oshinsky LLP 2101 L Street NW Washington, DC 20037-1526			JERABEK, KELLY L	
			ART UNIT	PAPER NUMBER
			2612	
DATE MAILED: 05/20/2004				

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/550,816	ANDERSSON ET AL.	
	Examiner	Art Unit	
	Kelly L. Jerabek	2612	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on 09 March 2004.
- 2a) This action is FINAL. 2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-24 is/are pending in the application.
 - 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) Claim(s) _____ is/are allowed.
- 6) Claim(s) 1,2,7-9,11,12,16-18 and 22-24 is/are rejected.
- 7) Claim(s) 3-6,10,13-15 and 19-21 is/are objected to.
- 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on 09 March 2004 is/are: a) accepted or b) objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) Notice of References Cited (PTO-892)
- 2) Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) Notice of Informal Patent Application (PTO-152)
- 6) Other: _____.

DETAILED ACTION

Drawings

The drawings were received on 3/9/2004. These drawings are acceptable.

Response to Arguments

Applicant's arguments filed 3/9/2004 with respect to claims 1, 7, 11, and 16 have been fully considered but they are not persuasive.

Response to Remarks:

Applicant states (Amendment, pages 11-12) that the present invention relates to active pixel sensors with undesirable fixed pattern noise. The present invention helps to reduce fixed pattern noise by passing charge accumulated in a photoactive region through a second active region before the charge is transferred to a sense node or a power supply node of the pixel. The Examiner agrees that the invention according to the specification discloses this concept, however the claimed invention does not disclose the reduction of fixed pattern noise.

Applicant contends (Amendment, page 12) regarding claim 1 that neither Pain nor lida, whether considered individually or in combination, teaches or suggests the limitations of claim 1. The Examiner respectfully disagrees. Pain discloses in figures 2A, 2B, 3A, 3B, and 3C a method of transferring charge accumulated in a photoactive region (6) of a pixel of an image sensor during a first period (Pain: fig. 3D: TX2 high) to a power supply node (64). See also (Pain: col. 4, lines 55-57; col. 6, lines 23-29). Pain also discloses transferring charge accumulated in a photoactive of a pixel during a second period (Pain: fig. 3D, TX high) to a sense node (54) (Pain: col. 4, lines 58-61; col. 6, lines 40-50). Pain only lacks the teaching of passing charge accumulated in a photoactive region to a second active region. However, lida includes this feature. The amplifying transistor section of the pixel is the second active region (lida: col. 5, lines 17-18). The charge generated by the photodiode (3) is transferred through a storage diode (5) to the amplifying transistor in order to amplify the signal (lida: col. 5, lines 48-59). Finally the potential of the amplifying transistor can be read out through a signal line (lida: col. 5, lines 58-65). The amplifying transistor is a second active region that receives charge accumulated in the photoactive region and amplifies the signal before transferring it. Therefore, the combination of the Pain and lida references teaches "transferring charge accumulated in a photoactive region of the pixel during a first period, through a second active region of the pixel to a power supply node; and transferring charge, accumulated in the photoactive region during a second period, through the second active region to a sense node in the pixel".

Applicant contends (Amendment, p. 13) regarding claim 1 that there is no motivation in Pain or lida to combine their teaching in the manner suggested in the Office Action, particularly where neither addresses the fixed pattern noise problem addressed by the claimed invention. The Examiner respectfully disagrees. It is true that neither reference distinctly addresses fixed pattern noise, however the claimed invention is silent with respect to fixed pattern noise. The Pain reference discloses transferring photocharges accumulated in the photoactive region to a sense node during a first period and transferring the photocharges to a power supply node during a second period (Pain: col. 3, lines 10-29). The lida reference discloses transferring charges accumulated in a photodiode (3) to a second active region (amplifying transistor) in order to amplify the signal and then externally reading the signal out though a signal line (lida: col. 5, lines 49-65). Therefore, it would have been obvious for one skilled in the art to have been motivated to include the second active region of the pixel (amplifying transistor) disclosed by lida in the CMOS active pixel sensor including sense nodes and power supply nodes as disclosed by Pain. Doing so would serve to amplify the signal taken in by the first active region before reading it out, thus reducing the size of the pixels and maintaining the low dark-current characteristics of the photodiode (lida: col. 6, lines 30-32).

Applicant contends (Amendment, page 13) regarding claim 7 that neither Pain nor lida, whether considered individually or in combination, teaches or suggests the limitations of claim 7. The Examiner respectfully disagrees. Pain discloses in figures 2A, 2B, 3A, 3B, and 3C a method of transferring charge accumulated in a photoactive

region (6) of a pixel of an image sensor during a first period (Pain: fig. 3D: TX2 high) to a power supply node (64). See also (Pain: col. 4, lines 55-57; col. 6, lines 23-29). Pain also discloses transferring charge accumulated in a photoactive of a pixel during a second period (Pain: fig. 3D, TX high) to a sense node (54) (Pain: col. 4, lines 58-61; col. 6, lines 40-50). Furthermore, Pain discloses that the transfer to the sense node occurs simultaneously for all of the pixels (Pain: col. 5, lines 22-26). Pain only lacks the teaching of passing charge accumulated in a photoactive region to a second active region. However, lida includes this feature. The amplifying transistor section of the pixel is the second active region (lida: col. 5, lines 17-18). The charge generated by the photodiode (3) is transferred through a storage diode (5) to the amplifying transistor in order to amplify the signal (lida: col. 5, lines 48-59). Finally the potential of the amplifying transistor can be read out through a signal line (lida: col. 5, lines 58-65). The amplifying transistor is a second active region that receives charge accumulated in the photoactive region and amplifies the signal before transferring it. Therefore, the combination of the Pain and lida references teaches “transferring...charge accumulated during a first period...to a power supply node of the pixel through a second active region of the pixel...transferring the charge accumulated...during the second period to a respective sense node in the pixel through the second active region of the pixel...”.

Applicant contends (Amendment, p. 14) regarding claim 7 that there is no motivation in Pain or lida to combine their teaching in the manner suggested in the Office Action, particularly where neither addresses the fixed pattern noise problem addressed by the claimed invention. The Examiner respectfully disagrees. It is true

that neither reference distinctly addresses fixed pattern noise, however the claimed invention is silent with respect to fixed pattern noise. The Pain reference discloses transferring photocharges accumulated in the photoactive region to a sense node during a first period and transferring the photocharges to a power supply node during a second period (Pain: col. 3, lines 10-29). The lida reference discloses transferring charges accumulated in a photodiode (3) to a second active region (amplifying transistor) in order to amplify the signal and then externally reading the signal out though a signal line (lida: col. 5, lines 49-65). Therefore, it would have been obvious for one skilled in the art to have been motivated to include the second active region of the pixel (amplifying transistor) disclosed by lida in the CMOS active pixel sensor including sense nodes and power supply nodes as disclosed by Pain. Doing so would serve to amplify the signal taken in by the first active region before reading it out, thus reducing the size of the pixels and maintaining the low dark-current characteristics of the photodiode (lida: col. 6, lines 30-32).

Applicant contends (Amendment, pages 14 and 15) regarding claim 11 that neither Pain nor lida, whether considered individually or in combination, teaches or suggests the limitations of claim 11. The Examiner respectfully disagrees. Pain discloses an image sensor comprising a plurality of pixels (Pain: fig. 1: 30; figs. 2A, 2B, 3A, 3B, 3C; col. 4, lines 39-43). Each pixel includes a photoactive region (fig. 2A: 60), sense node (fig. 2A: 54), a power supply node (fig. 2A: 64), and a controller (fig. 1: 32). The controller Pain discloses transfers charge accumulated in a photoactive region (60)

of a pixel of an image sensor during a first period (fig. 3D: TX2 high) to a power supply node (fig. 2A: 64). See also (Pain: col. 4, lines 55-57; col. 6, lines 23-29). In addition, the controller transfers charge accumulated in a photoactive of a pixel during a second period (fig. 3D, TX high) to a sense node (Pain: fig. 2A: 54; col. 4, lines 58-61; col. 6, lines 40-50). Pain only lacks the teaching of passing charge accumulated in a photoactive region to a second active region. However, lida includes this feature. The amplifying transistor section of the pixel is the second active region (lida: col. 5, lines 17-18). The charge generated by the photodiode (3) is transferred through a storage diode (5) to the amplifying transistor in order to amplify the signal (lida: col. 5, lines 48-59). Finally the potential of the amplifying transistor can be read out through a signal line (lida: col. 5, lines 58-65). The amplifying transistor is a second active region that receives charge accumulated in the photoactive region and amplifies the signal before transferring it. Therefore, the combination of the Pain and lida references teaches “...the pixel to: transfer charge accumulated, in the pixel's photoactive region during a first period, to the power supply node through the pixel's second active region; and transfer charge, accumulated in the pixel's photoactive region during a second period, to the pixel's sense node through the pixel's second active region”.

Applicant contends (Amendment, p. 15) regarding claim 11 that there is no motivation in Pain or lida to combine their teaching in the manner suggested in the Office Action, particularly where neither addresses the fixed pattern noise problem addressed by the claimed invention. The Examiner respectfully disagrees. It is true that neither reference distinctly addresses fixed pattern noise, however the claimed

invention is silent with respect to fixed pattern noise. The Pain reference discloses transferring photocharges accumulated in the photoactive region to a sense node during a first period and transferring the photocharges to a power supply node during a second period (Pain: col. 3, lines 10-29). The lida reference discloses transferring charges accumulated in a photodiode (3) to a second active region (amplifying transistor) in order to amplify the signal and then externally reading the signal out though a signal line (lida: col. 5, lines 49-65). Therefore, it would have been obvious for one skilled in the art to have been motivated to include the second active region of the pixel (amplifying transistor) disclosed by lida in the CMOS active pixel sensor including sense nodes and power supply nodes as disclosed by Pain. Doing so would serve to amplify the signal taken in by the first active region before reading it out, thus reducing the size of the pixels and maintaining the low dark-current characteristics of the photodiode (lida: col. 6, lines 30-32).

Applicant contends (Amendment, 16) regarding claim 16 that neither Pain nor lida, whether considered individually or in combination, teaches or suggests the limitations of claim 16. The Examiner respectfully disagrees. Pain discloses an image sensor comprising a plurality of pixels (fig. 1: 30; figs. 2A, 2B, 3A, 3B, 3C; col. 4, lines 39-43). Each pixel includes a photoactive region (fig. 2A: 60), sense node (fig. 2A: 54), a power supply node (fig. 2A: 64), and a controller (fig. 1: 32). The controller Pain discloses causes the pixels to operate in several different modes. In one mode a photocharge is accumulated in the pixel's photoactive region (col. 4, lines 44-47). In

Art Unit: 2612

another mode, charge is transferred to the pixel's power supply node (col. 4, lines 55-57). In another mode, charge is transferred to the pixel's sense node (col. 4, lines 58-61). Pain only lacks the teaching of a mode (i.e. second mode) in which charge is transferred from the pixel's photoactive region to the pixel's second active region. However, lida includes this feature. The amplifying transistor section of the pixel is the second active region (lida: col. 5, lines 17-18). The charge generated by the photodiode (3) is transferred through a storage diode (5) to the amplifying transistor in order to amplify the signal (lida: col. 5, lines 48-59). Finally the potential of the amplifying transistor can be read out through a signal line (lida: col. 5, lines 58-65). The amplifying transistor is a second active region that receives charge accumulated in the photoactive region and amplifies the signal before transferring it. Therefore, the combination of the Pain and lida references teaches the limitations of claim 16.

Applicant contends (Amendment, p. 16) regarding claim 16 that there is no motivation in Pain or lida to combine their teaching in the manner suggested in the Office Action, particularly where neither addresses the fixed pattern noise problem addressed by the claimed invention. The Examiner respectfully disagrees. It is true that neither reference distinctly addresses fixed pattern noise, however the claimed invention is silent with respect to fixed pattern noise. The Pain reference discloses transferring photocharges accumulated in the photoactive region to a sense node during a first period and transferring the photocharges to a power supply node during a second period (Pain: col. 3, lines 10-29). The lida reference discloses transferring charges accumulated in a photodiode (3) to a second active region (amplifying transistor) in

order to amplify the signal and then externally reading the signal out though a signal line (lida: col. 5, lines 49-65). Therefore, it would have been obvious for one skilled in the art to have been motivated to include the second active region of the pixel (amplifying transistor) disclosed by lida in the CMOS active pixel sensor including sense nodes and power supply nodes as disclosed by Pain. Doing so would serve to amplify the signal taken in by the first active region before reading it out, thus reducing the size of the pixels and maintaining the low dark-current characteristics of the photodiode (lida: col. 6, lines 30-32).

Claim Rejections - 35 USC § 103

Claims 1-2,7-9,11-12,16-18, and 22-24 rejected under 35 U.S.C. 103(a) as being unpatentable over Pain et al. US 6,326,230 in view of lida et al. US 6,215,139.

Re claim 1, Pain discloses in figures 2A, 2B, 3A, 3B, and 3C a method of transferring charge accumulated in a photoactive region (6) of a pixel of an image sensor during a first period (fig. 3D: TX2 high) to a power supply node (64). See also (col. 4, lines 55-57; col. 6, lines 23-29). Pain also discloses transferring charge accumulated in a photoactive of a pixel during a second period (fig. 3D, TX high) to a sense node (54) (col. 4, lines 58-61; col. 6, lines 40-50). However, Pain does not

explicitly state that the charge is transferred intermediately through a second active region for each of the two periods.

Iida discloses an image sensor (fig. 1) including a plurality of unit pixels each having two active regions (col. 4, lines 54-57). The first active region consists of a photodiode (fig. 1: 3) and a storage diode (fig. 1: 5). The second active region consists of an amplifying transistor section (col. 2, lines 28-35; col. 5, lines 14-24). A second active region is advantageous because it is an intermediate region between the photoactive region and the nodes that can be used to amplify the signal in order to maintain low dark-current characteristics of the photodiode (col. 5, line 55 – col. 6, line 7; col. 6, lines 21-32). For this reason, it would have been obvious to include a second active region as taught in Iida in the method of transferring charge disclosed by Pain. Doing so would ensure that the charge transferred from the photoactive region to the power supply node and sense node following pixel integration will be relatively free of having low dark-current characteristics.

Re claim 2, Iida states that the electric signal charge stored in the storage diode (fig. 1: 5) modulates the potential of the amplifying gate (fig. 1: 12) of the amplifying transistor (col. 5, lines 55-65). In addition, Iida mentions that prior to photoelectric conversion the potential of the storage diode is reset at the level of the reset drain (col. 5, lines 42-47). Therefore, since the charge stored in the storage diode modulates the potential of the amplifying gate it can be seen that the amount of charge in the second active region can be set prior to transferring charge accumulated during the first period.

Re claim 7, Pain discloses a method of operating an image sensor comprising an array of pixels (fig. 1: 30; figs. 2A, 2B, 3A, 3B, 3C; col. 4, lines 39-43). The method Pain discloses consists of transferring charge accumulated in a photoactive region (60) of a pixel of an image sensor during a first period (fig. 3D: TX2 high) to a power supply node (fig. 2A: 64). See also (col. 4, lines 55-57; col. 6, lines 23-29). Pain also discloses transferring charge accumulated in a photoactive of a pixel during a second period (fig. 3D, TX high) to a sense node (fig. 2A: 54; col. 4, lines 58-61; col. 6, lines 40-50). Furthermore, Pain discloses that the transfer to the sense node occurs simultaneously for all of the pixels (col. 5, lines 22-26). Additionally, Pain mentions that a photocharge integration period occurs for all the pixels in the sensor at the same time (col. 5, lines 24-27). Pain also mentions all of the pixels transfer charge at substantially the same time (col. 5, lines 45-52). However, Pain does not explicitly state that the charge is transferred intermediately through a second active region for each of the two periods.

Iida discloses an image sensor (fig. 1) including a plurality of unit pixels each having two active regions (col. 4, lines 54-57). The first active region consists of a photodiode (fig. 1: 3) and a storage diode (fig. 1: 5). The second active region consists of an amplifying transistor section (col. 5, lines 14-24). A second active region is advantageous because it is an intermediate region between the photoactive region and the nodes that can be used to amplify the signal in order to maintain low dark-current characteristics of the photodiode (col. 5, line 55 – col. 6, line 7; col. 6, lines 21-32). For this reason, it would have been obvious to include a second active region as taught in Iida in the method of transferring charge disclosed by Pain. Doing so would ensure that

the charge transferred from the photoactive region to the power supply node and sense node following pixel integration will be relatively free of having low dark-current characteristics.

Re claim 8, Pain mentions that pixel signal levels from the array (fig. 1,30) are read out one row at a time (col. 5, lines 53-58), wherein a pixel signal level corresponds to the charge previously transferred to a pixel's sense node (col. 5, lines 56-58).

Re claim 9, Pain mentions resetting the pixel's sense node (col. 5, lines 59-61), transferring charge to the pixel's sense node (col. 6, lines 41-50), and reading out a pixel reset level corresponding to the charge most recently transferred to the pixels' sense node (col. 5, lines 53-64). However, Pain does not explicitly state that the charge is transferred intermediately through a second active region.

Iida discloses an image sensor (fig. 1) including a plurality of unit pixels each having two active regions (col. 4, lines 54-57). The first active region consists of a photodiode (fig. 1: 3) and a storage diode (fig. 1: 5). The second active region consists of an amplifying transistor section (col. 2, lines 28-35; col. 5, lines 14-24). A second active region is advantageous because it is an intermediate region between the photoactive region and the nodes that can be used to amplify the signal in order to maintain low dark-current characteristics of the photodiode (col. 5, line 55 – col. 6, line 7; col. 6, lines 21-32). Furthermore, the amount of charge in the second active region can be reset to a predetermined level (col. 5, lines 42-47). For this reason, it would

have been obvious to include a second active region as taught in lida in the method of transferring charge disclosed by Pain. Doing so would ensure that the charge transferred from the photoactive region to the power supply node and sense node following pixel integration will be relatively free of having low dark-current characteristics.

Re claim 11, Pain discloses an image sensor comprising a plurality of pixels (fig. 1: 30; figs. 2A, 2B, 3A, 3B, 3C; col. 4, lines 39-43). Each pixel includes a photoactive region (fig. 2A: 60), sense node (fig. 2A: 54), a power supply node (fig. 2A: 64), and a controller (fig. 1: 32). The controller Pain discloses transfers charge accumulated in a photoactive region (60) of a pixel of an image sensor during a first period (fig. 3D: TX2 high) to a power supply node (fig. 2A: 64; col. 4, lines 55-57; col. 6, lines 23-29). In addition, the controller transfers charge accumulated in a photoactive region of a pixel during a second period (fig. 3D, TX high) to a sense node (fig. 2A: 54; col. 4, lines 58-61; col. 6, lines 40-50). However, Pain does not explicitly state that the charge is transferred intermediately through a second active region for each of the two periods.

lida discloses an image sensor (fig. 1) including a plurality of unit pixels each having two active regions (col. 4, lines 54-57). The first active region consists of a photodiode (fig. 1: 3) and a storage diode (fig. 1: 5). The second active region consists of an amplifying transistor section (col. 5, lines 14-24). A second active region is advantageous because it is an intermediate region between the photoactive region and the nodes that can be used to amplify the signal in order to maintain low dark-current

characteristics of the photodiode (col. 5, line 55 – col. 6, line 7; col. 6, lines 21-32). For this reason, it would have been obvious to include a second active region as taught in lida in the method of transferring charge disclosed by Pain. Doing so would ensure that the charge transferred from the photoactive region to the power supply node and sense node following pixel integration will be relatively free of having low dark-current characteristics.

Re claim 12, lida states that the electric signal charge stored in the storage diode (fig. 1: 5) modulates the potential of the amplifying gate (fig. 1: 12) of the amplifying transistor (col. 5, lines 55-65). In addition, lida mentions that prior to photoelectric conversion the potential of the storage diode is reset at the level of the reset drain (col. 5, lines 42-47). Therefore, since the charge stored in the storage diode modulates the potential of the amplifying gate it can be seen that the amount of charge in the second active region can be set prior to transferring charge accumulated during the first period.

Re claim 16, Pain discloses an image sensor comprising a plurality of pixels (fig. 1: 30; figs. 2A, 2B, 3A, 3B, 3C; col. 4, lines 39-43). Each pixel includes a photoactive region (fig. 2A: 60), sense node (fig. 2A: 54), a power supply node (fig. 2A: 64), and a controller (fig. 1: 32). The controller Pain discloses causes the pixels to operate in several different modes. In one mode a photocharge is accumulated in the pixel's photoactive region (col. 4, lines 44-47). In another mode, charge is transferred to the pixel's power supply node (col. 4, lines 55-57). In another mode, charge is transferred

to the pixel's sense node (col. 4, lines 58-61). However, Pain fails to teach a mode (i.e. second mode) in which charge is transferred from the pixel's photoactive region to the pixel's second active region.

Iida discloses an image sensor (fig. 1) including a plurality of unit pixels each having two active regions (col. 4, lines 54-57). The first active region consists of a photodiode (fig. 1: 3) and a storage diode (fig. 1: 5). The second active region consists of an amplifying transistor section (col. 5, lines 14-24). A second active region is advantageous because it is an intermediate region between the photoactive region and the nodes that can be used to amplify the signal in order to maintain low dark-current characteristics of the photodiode (col. 5, line 55 – col. 6, line 7; col. 6, lines 21-32). The second active region may be utilized in the second, third, and fourth controller modes respectively. For this reason, it would have been obvious to include a second active region as taught in Iida in the image sensor disclosed by Pain. Doing so would ensure that the charge transferred from the photoactive region to the power supply node and sense node following pixel integration will be relatively free of having low dark-current characteristics.

Re claim 17, Pain mentions that charge accumulated in the photoactive region during a first period (fig. 3D: TX2 high) is transferred to the power supply node, and prevented from flowing to the sense nodes (col. 6, lines 1-11). Pain also mentions that the charge accumulated in the photoactive region during a second period (fig. 3D, TX high) is transferred directly to the sense node (col. 6, lines 41-49). Therefore when the

teaching of Pain is combined with the teaching of lida as mentioned above in claim 16, charge accumulated during the first period will be transferred through the second active region to the pixel's power supply node without passing through the pixel's sense node. Also, charge accumulated during the second period will be transferred through the second active region to the pixel's sense node.

Re claim 18, lida states that the electric signal charge stored in the storage diode (fig. 1: 5) modulates the potential of the amplifying gate (fig. 1: 12) of the amplifying transistor (col. 5, lines 55-65). In addition, lida mentions that prior to photoelectric conversion the potential of the storage diode is reset at the level of the reset drain (col. 5, lines 42-47). Therefore, since the charge stored in the storage diode modulates the potential of the amplifying gate it can be seen that the amount of charge in the second active region can be set prior to transferring charge accumulated during the first period.

Re claim 22, Pain states that the pixels include active pixel sensors (col. 1, lines 33-34).

Re claim 23, Pain states that the pixels include photo-gate type active pixel sensors (col. 1, lines 61-62).

Re claim 24, Pain mentions that a photocharge integration period occurs for all the pixels in the sensor at the same time (col. 5, lines 24-27). Pain also mentions all of the pixels transfer charge at substantially the same time (col. 5, lines 45-52).

Allowable Subject Matter

Claims 3-6,10,13-15, and 19-21 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Contacts

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kelly L. Jerabek whose telephone number is 703-305-8659. The examiner can normally be reached on Monday - Friday (8:00 AM - 5:00 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wendy Garber can be reached on 703-305-4929. The fax phone number for submitting all Official communications is 703-872-9306. The fax phone number for submitting informal communications such as drafts, proposed amendments, etc., may be faxed directly to the Examiner at 703-746-3059.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

KLJ



NGOC-YEN VU
PRIMARY EXAMINER